sonchifolius Poepp. & Endl.) as affected by storage conditions and cultivar

Sophie Graefe[1], Ivan Manrique[2], Michael Hermann[2] and Andreas Buerkert[1]

[1]Institute of Crop Science, University of Kassel, Witzenhausen, Germany and [2]International Potato Center (CIP), Lima, Peru

Introduction

Yacon (*Smallanthus sonchifolius* Poepp. & Endl.; Figure 1) is a little-known native root crop of the Andes, which is typically cultivated in family gardens and field margins at altitudes between 1,500 and 3,200 m asl. The main constituent of yacon roots are oligofructans, which are polymers of fructose linked by ß-(2→1) glucosidic bonds, a carbohydrate the human body has no enzyme to hydrolyse. Therefore oligofructans are an ideal dietary sugar for diabetics. To increase the relative sweetness of the roots, these are preferably consumed after they have been exposed to the sun for several days. The juice of the roots can also be concentrated into a syrup. In recent years, rural farming communities began to extend the cultivation and processing of yacon to produce an alternative sweetener for the booming health food market. As oligofructans in yacon tend to depolymerise into reducing sugars (glucose, fructose, sucrose) fairly quickly after harvest, post-harvest compositional changes of the root are a concern to producers and processors alike.

Figure 1. Peruvian farmer digging out a mature yacon plant (left). Usually around 20 fleshy roots are clustered together to form the underground storage organ (top).

Materials and Methods

The main purpose of this study was to examine how genotype and altitude-related temperature affect post-harvest decomposition of oligofructans in the yacon root over time. To this end three experiments were conducted with three local yacon varieties but this poster only reports results from two experiments focusing on a single (white) variety. The first experiment, conducted at 2,000 m asl, addressed the traditional exposure of roots to sunlight ('soleado') and the second experiment the short-term storage under farmers' conditions at both 2,000 and 3,000 m asl. At the different sampling intervals the root material was subject to carbohydrate analysis (oligofructans, fructose, glucose and sucrose) using enzymatic methods of Megazyme International (Ireland) for oligofructans and Boehringer Mannheim (Germany) for free sugars, respectively.

Results

For the white variety reported here the 'soleado' experiment revealed a significant decrease in oligofructan concentration from 62% to 44% over six days. During this period concentrations of free sugars (glucose, fructose and sucrose) increased accordingly. Whereas the fructose concentration increased constantly during six days of sun exposure, the proportional reduction of oligofructans and the increment of sucrose and glucose was slowed down at the end of the experiment (Figure 2). The short-term storage experiment at the two altitudes showed a similarly rapid conversion of oligofructans during early storage. After the first six days the oligofructans remaining after depolymerisation were lower at 2,000 m (49%) than at 3,000 m (57%), but after 12 days oligofructan concentrations were with 40% similar at both altitudes. The increase in free sugars was significant but did not seem to be affected by different altitudes (Table 1). As expected the correlation between oligofructans and fructose during the short-term storage experiment was strongly inverse (Figure 3).

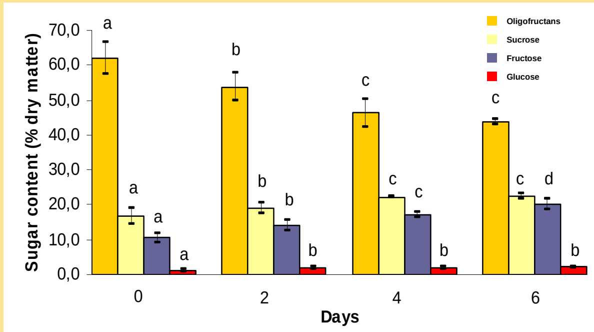

Figure 2. Changes in sugar composition of a white yacon variety during sun exposure for several days. Sugar types with the same letter are not significantly different at $P < 0.05$.

Table 1. Changes in sugar composition of white yacon variety during short-term storage at different altitudes (in % dry matter).

Altitude m asl	Days of storage	Oligofructans	Fructose	Sucrose	Glucose
2,000	0	62.1 a	10.5 a	16.9 a	1.1 a
	6	48.6 b	18.9 b	21.7 b	1.4 a
	12	39.2 c	21.8 c	25.5 c	1.1 a
	lsd	*6.8*	*2.5*	*2.5*	*0.4*
3,000	0	62.1 a	10.5 a	16.9 a	1.1 a
	6	56.7 b	18.9 b	20.7 b	1.6 ab
	12	39.8 c	23.0 b	22.9 b	2.2 b
	lsd	*5.2*	*4.3*	*3.8*	*0.7*

Means of columns for each altitude factor are not significantly different at $P < 0.05$.

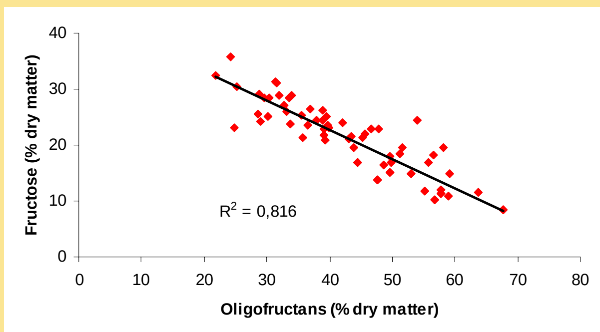

Figure 3. Correlation of oligofructan and fructose contents during the short-term storage experiment.

Conclusions

The results indicate that a major hydrolysis of oligofructans takes place within only a few days during the storage of yacon roots under farmers' conditions leading to large amounts of fructose, sucrose and glucose. The greatest sugar conversion was reached at the high temperature and solar radiation of the 'soleado' experiment leading to dried, sweet roots. Lower day and night temperatures at 3,000 m asl seem to slow down the onset of the oligofructan conversion within the first week of storage. To obtain oligofructan rich derivates (e.g. syrup) roots should be processed as soon as possible after harvest. This requires an effective rural infrastructure, such as community-based processing facilities allowing farmers to add value to agricultural output. Overall, ecological cultivation and processing of yacon has a great potential to increase farmers' income in low input small-scale Andean cropping systems in the near future.

Acknowledgements

The authors greatly appreciate the financial support by the Vater und Sohn Eiselen-Foundation Ulm and would like to thank the International Potato Center for covering laboratory expenses and providing logistical assistance.